Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 74

MISSINAIBI LAKE AREA

(NTS 42B/SW)

Districts of Algoma and Sudbury

MINISTRY OF NORTHERN AFFAIRS AND MINES
ONTARIO GEOLOGICAL SURVEY
Not for resale

by

Hulbert A. Lee and S.A. Scott

1980

Ontario

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93-02410/

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THIS PROJECT WAS FUNDED BY
THE ONTARIO MINISTRY OF NORTHERN AFFAIRS
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THE ONTARIO MINISTRY OF NATURAL RESOURCES

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Orders for publications should be accompanied by cheque or money order payable to the *Treasurer of Ontario.*

ISSN 0709-4671
ISBN 0-7743-4350-8

Parts of this publication may be quoted if credit is given. It is recommended that reference to this report be made in the following form:

Lee, Hulbert A, and Scott, S.A.
1980: Missinaibi Lake Area (NTS 42B/SW), Districts of Algoma and Sudbury; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 74, 12 p. Accompanied by Map 5101, scale 1:100 000.

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MAP
(accompanying report)

Map 5101 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Missinaibi Lake (NTS 42B/SW). Scale 1:100 000.

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by

Hulbert A. Lee[1] and S.A. Scott[2]

1.0 INTRODUCTION

This report accompanies a Data Base Map (OGS Map 5101) which characterizes the terrain in the Missinaibi Lake area, Districts of Algoma and Sudbury by means of letter symbols that relate directly to reconnaissance engineering conditions. The area, which covers NTS block 42B/SW, lies between Latitudes 48°00'N and 48°30'N and Longitudes 83°00'W and 84°00'W. The report is one of a series which provides uniform terrain data for approximately 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide complete data coverage which can then be utilized for engineering and resource planning. The explanatory notes in this report are intended to expand on characteristics of the terrain units that are specific to the Missinaibi Lake map-area, and to describe the engineering significance of the units.

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Manuscript approved for publication by the Chief, Engineering and Terrain Geology Section, August 28, 1979. This report is published with the permission of E.G. Pye, Director, Ontario Geological Survey.

The primary method of mapping was airphoto interpretation, using existing black and white photographs at a scale of approximately 1:50 000. Prior to interpretation, both a literature search and ground reconnaissance were carried out. Preliminary data thus obtained, including geology, outcrop distribution, and relief, were plotted on a copy of the base map. A quick overview of the map-area was gained from both colour and black-and-white satellite imagery. Ground reconnaissance consisted of travelling through all accessible areas by road and rail, making terrain observations, sampling soil materials, and taking photographs. Thus the map represents a reconnaissance level presentation of engineering conditions.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. The letter symbols function as a shorthand, describing surface materials, genetic landforms, topography, and drainage. Further information on the mapping techniques, legend format, and possible uses of the terrain data is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING

The Missinaibi Lake map-area is mainly an upland environment. Elevations (above mean sea level) range from 325 m in the north to 430 m in the south, with some hills rising to 530 m. The area is drained northward by the Chapleau, Makonie, and Missinaibi Rivers and their tributaries. The lakes, here an integral part of the drainage system, show a strong north-northeasterly trend.

2.1 BEDROCK

The rocks underlying the Missinaibi Lake map-area are all Early Precambrian in age, with the exception of a Late Precambrian intrusive body in the southeast corner. For engineering purposes, they can be considered as solid and firm. The rocks have been mapped by broad helicopter reconnaissance methods (Thurston, Siragusa, and Sage 1971, 1977), with parts of the area having been studied in more detail by Burwash (1937),

Bruce (1944), Parsons (1961), Ferguson (1968), Riley (1971), and Bennett (1972, 1978).

Most of the area is underlain by complex felsic intrusive rocks which have penetrated metasediments and other metamorphic rocks to produce migmatites and gneisses. These form hills as rock knobs of considerable relief, greater than 15 m and commonly greater than 60 m; the slopes are generally steep. Some of the metasediments such as those in southwestern Lipsett Township and southeastern Brutus Township, weather low and flat, forming rock plains with undulating surfaces.

A belt of metavolcanics ('greenstones') is found in the northwestern part of the area, occupying parts of Rennie, Leeson, Stover, Brockin, Marsh, and Lang Townships. These metavolcanics form rock ridges of moderate relief and with "cliffed" edges.

The carbonatite-syenite plug on the east shore of Nemegosenda Lake in the southeast corner of the map-area forms rock knobs of intermediate relief. The Kapuskasing metamorphic complex passes through the adjoining map-area to the east and may underlie the eastern edge of Bonar Township and the northern half of Copperfield Township.

2.2 SURFICIAL

Data on surficial geology is contained on a reconnaissance map compiled by Boissoneau (1965), but to date there has been no systematic detailed study of the map-area.

A north-northeastward withdrawal of ice-margins during Wisconsinan time left behind a swarm of glaciofluvial esker and outwash systems, located mainly in the eastern two-thirds of the map-area. This ice-margin withdrawal shifted to a more northeasterly direction in the northwestern portion of the area. Ice flow behind these margins laid down bouldery, sandy till and occasionally produced drumlins and other ice-flow features. Most of this map-area is above the level of former Glacial Lake Barlow-Ojibway. There are, however, a few local ice-marginal ponds which have produced silty sand lake plains along the esker passing through Sadler and Pattinson Townships, and some lake plain silt along the Missinaibi River at the northern edge of the map-area.

Organic terrain, consisting mainly of sphagnum peat, has developed since deglaciation in confined bogs within the poorly-drained areas.

3.0 DESCRIPTION OF ENGINEERING TERRAIN UNITS

The terrain units described below are arranged by landform in descending order of areal importance within the Missinaibi Lake map-area. A representative selection of terrain unit symbols is given for each landform, each with accompanying explanation. This treatment is meant to familiarize the reader with the meaning of the legend symbols and allow more effective use of the Data Base Map (OGS Map 5101, accompanying this report). A discussion of the engineering significance of the various terrain units is given in Section 5.0.

3.1 BEDROCK

RN(tbsMG) / Hjn-D RN(tMG) / Hjs-D RN(tMG) / Msj-D

Rock knobs (RN) are the dominant engineering factor in this type of bedrock terrain, which covers most of the map-area. The rock is generally within 1 m of the surface. Ground moraine (MG), consisting of bouldery sandy till (tbs), is found among rock knobs and as a thin veneer. The local relief is generally greater than 60 m (H) or occasionally between 15 and 60 m (M). The land surface has steep slopes (s), is rugged (j) or knobby (n), and is dry (D).

tMG/RN / Mu-D tMG/RN / Msn-D tMG/RN / Hsu-D

Rock knobs (RN) are the dominant engineering factor in this bedrock terrain type, which is scattered throughout the map-area. Ground moraine till (tMG) forms a fairly continuous capping 1 to 3 m thick. The local relief is moderate (M) or high (H). The land surface on this terrain unit varies across the map-area; it may be undulating (u) with steep slopes (s) or knobby (n). Surface drainage conditions are generally dry (D).

RR(tMG) / Mj*-D

Rock ridges (RR), composed of elongated hills and associated with some thickening of ground moraine till (tMG), characterize the terrain in parts of Brackin, Leeson, and Stover Townships. The local relief is 15 to 60 m (M) and the rocks have numerous low cliffs (j*). Surface drainage conditions are dry (D).

RP(tsMG) / Lu-D

Rock plain (RP), with scattered low outcrops or a flat bedrock surface barely covered by debris and with minor sandy till ground moraine, characterizes some of the bedrock terrain in Sadler and Floranna Townships.

3.2 GLACIOFLUVIAL

gsGE(RN) / Mpk-D sgGE(RN) / Mrk-D

sgGE(RN) (pOT) / Mu-D

An esker complex (GE) consisting of gravel and sand (gs) or sand and gravel (sg), characterizes the glaciofluvial terrain in the northwest corner of the map-area. The gravel and sand occurs over and around bedrock knobs (RN). Local relief is about 15 to 60 m (M). The land surface can be planar (p) with kettle holes (k), ridged (r), or undulating (u). Surface drainage conditions are dry (D).

sGO(RN) / Mu-D sGO(RN) / Lu-D

sGO(RN) / Lp-D sgGE(pOT) / Ldp-D(W)

Outwash (GO), consisting mainly of sand (s) or occasionally sand and gravel (sg), is a common feature of the terrain along the southern edge of the map-area. This outwash is often associated with an esker. Local relief is generally less than 5 m (L), but can be 15 to 60 m (M). The land surface is undulating (u) or planar (p), and locally dissected (d). Surface drainage conditions are dry (D).

$\frac{tMG/sgGE}{Mk\text{-}D}$ $\frac{tMG/sgGE}{Lk\text{-}D}$ $\frac{tMG/sgGE}{Mnk\text{-}D}$

An esker complex (GE), composed of sand and gravel (sg), with a local thin capping of ground moraine till (tMG), passes through eastern Lloyd Township. Local relief is 15 to 60 m (M) and, in places, less than 15 m (L). The land surface is kettled (k), hummocky (n), and dry (D).

3.3 MORAINAL

$\frac{tMG(RN)}{Hjs\text{-}D}$ $\frac{tMG(RN)}{Hs\text{-}D}$

Ground moraine (MG), composed of till (t) forms a cover a few metres thick in Ramsden and Mageau Townships. In places, the till is absent and rock knobs (RN) are exposed.

$\frac{tsMG(pOT)}{Mu\text{-}D(W)}$ $\frac{tbsMG(pOT)\,(RN)}{Mu\text{-}D(W)\,(D)}$

Ground moraine (MG), consisting of sandy till (ts) or locally very bouldery sandy till (tbs), characterizes the morainal terrain in Copperfield Township. There are scattered bogs, (pOT) and, occasionally, a few protruding rock knobs (RN). Local relief is about 15 to 60 m (M) and the land surface is undulating (u). Drainage conditions are dry (D) on the ground moraine and rock knobs and wet (W) on the organic terrain.

3.4 GLACIOLACUSTRINE

$\frac{smLP(RN)}{Lud\text{-}D}$

Lake plain sand and silt deposits (smLP), with a few scattered rock knobs (RN), characterize the glaciolacustrine terrain in the southeastern part of the map-area. The local relief is less than 15 m (L), the land surface is undulating (u) and dissected (d), and surface drainage conditions are dry (D).

$\frac{mLP(RN)\,(pOT)}{Ldc\text{-}M}$ $\frac{mLP}{Md\text{-}D}$

Lake plain silt deposits (mLP) characterize the glaciolacustrine terrain at the northern

edge of the map-area. There are some interspersed rock knobs (RN) and local confined bogs (pOT). Relief is less than 15 m (L) or 15 to 60 m (M). The land surface is dissected and (d), locally channelled (c), and drainage is mixed (M).

3.5 ORGANIC

pOT
Lp-W

Organic terrain composed mainly of sphagnum peat (pOT) characterizes most of organic terrain in the map-area. Relief is low (L), the land surface is planar (p), and surface drainage conditions are dry (D).

4.0 OBSERVATION NOTES

The following brief notes refer to sites in the Missinaibi Lake map-area at which ground observations were made. The corresponding numbered locations can be found on the Data Base Map.

Observation Site	Description
1	Outwash sand; terrain is low, undulating and dry
2	Outwash sand; a dry plain
3	Bouldery gravel outwash over rock knobs; terrain has medium relief, is undulating, and dry
4	Pit in esker; 10 m gravel face
5	Gravel pit in esker; bounded on west side by fault scarp and rock knobs
6	Outwash sand; low, undulatng and dry
7	Pit in ground moraine; over 1 m of bouldery, silty, sandy till; terrain has medium relief, undulating surface, and mixed drainage

8 Pit in esker node exposes crushable gravel

9 Pit in esker node exposes crushable gravel; road crossing esker ridges has both vertical and horizontal alignments

10 Exposure of bouldery gravelly till ground moraine; terrain has medium relief; the land surface is deeply dissected and dry

11 Pit with crushable gravel

12 Pit with 2 m face of sandy gravel outwash; terrain has medium relief; land surface is rolling and dry

13 Esker complex of cobbly gravel and sand over and around rock knobs; local relief is moderate; land surface is kettled and dry; surface and internal drainage good; high permeability

14 Depth of soil is 15 m (determined from 1 borehole). Drill log: medium sand; fine sand and silt; 'granite'; some 'greenstone' (Ontario Water Resources Commission 1972)

15 Depth of soil is 4 m (determined from 1 borehole). Drill log: 'clay' over 'red rock' (Ontario Water Resources Commission, 1972)

16 Sandy till ground moraine; sparse cobbles; resistance to hand penetrometer is 2070 kPa (300 psi); water table is low; surface and internal drainage are good; workability is good; size analysis on a sample tested by the Geoscience Laboratories, Ontario Geological Survey gives clay 0%, silt 34%, sand 54%

17 1 to 2 m of sandy till over rock

5.0 ENGINEERING AND RESOURCE SIGNIFICANCE

Missinaibi Lake and Chapleau-Nemegosenda Wild River Provincial Parks form wildlife and recreational reserves in the area.

Mineral resources, which provide the main economic potential, are at present mainly restricted to the metavolcanics in Rennie, Leeson, Stover, Brackin, and Lang Townships. In addition to a large number of gold and copper showings in these townships, one gold mine, the Renabie, was in operation for a period in the past; at the time this report was written, financial negotiations were underway in hopes of renewing production. The Townships of Collins and Chewett, underlain by alkaline intrusive rocks and carbonatite, have occurrences of rare earth minerals, phosphate, and uranium; this locality has definite potential for ore deposits, and has undergone some exploration.

Distribution of gravel and sand aggregate is widespread in the map-area; however, the depth of most deposits is not great, owing to the close proximity of bedrock to the surface. Therefore, the tonnage of individual deposits will not be high.

Areas suitable for forest management are limited, and restricted to the glaciofluvial, glaciolacustrine, and morainal terrain. Even in these areas, slopes are often steep and units of mixed outcrops are common.

5.1 BEDROCK TERRAIN

Approximately two-thirds of Missinaibi Lake map-area has bedrock at or near the surface, a factor which affects most types of construction. Only a few of the areas of bedrock terrain have low relief. Most of the bedrock is of medium and high relief, occasionally with an undulating surface, but usually with steep slopes and, in places, rugged and jagged surfaces. These areas will present the following difficulties for engineering and resource management:

1. blasting required for most types of below-ground excavations;
2. site-regrading due to steep slopes;
3. cut-and-fill operations, requiring blasting of bedrock for major transportation routes or the acceptance of considerable vertical and horizontal alignments;
4. lack of good and reliable sources of ground water, unless aquifer fractures are intersected in drilling; and
5. difficult environments for disposal of solid and toxic wastes.

5.2 GLACIOFLUVIAL TERRAIN

Many of the esker complexes have moderate relief and are sinuous in form, thus necessitating cut-and-fill operations to overcome the problems of gradients on steep slopes. Horizontal route alignments will be necessary around numerous small lakes, and considerable fill will be required for crossing deeper kettle holes. Much of the gravel in the glaciofluvial terrain is rounded and devoid of fine material, so that it has a tendency to wash out when used on steep embankments. The ground water table, as indicated by the level of water in kettle holes, is commonly low, resulting in a dry land surface. Septic tank installation will require some grading. Liquid waste disposal will cause pollution problems because of the permeable nature of the glaciofluvial materials.

Outwash terrain has low to moderate relief, and both trafficability and road construction involve fewer problems of alignment and cut-and-fill than in esker terrain. The water table is not as deep as in the high esker complexes, and there is normally a good supply of ground water. In the coarser soils of the outwash terrain, there is a hazard of pollution from septic and liquid waste disposal systems. The bearing strength is good on both esker and outwash materials, and excavation and workability of these soils is good.

5.3 GLACIOLACUSTRINE TERRAIN

Much of the glaciolacustrine terrain is composed of silt and fine sand, and wherever the land is elevated, erosion by dissection is extensive. This fine-grained soil reacts unfavourably to frost action, a factor which must be taken into account in the design of footings, small slabs, and roadways.

5.4 ORGANIC TERRAIN

Drainage, flooding, and settlement problems associated with the organic terrain units makes them generally unsuitable for roads and foundations.

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